Public Health Briefs

Garlic-in-Oil Associated Botulism: Episode Leads to Product Modification

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Abstract: In February 1989, three cases of botulism occurred in persons who consumed garlic bread made from a garlic-in-oil product. Testing of leftover garlic-in-oil showed it to have a pH of 5.7 and to contain high concentrations of *Clostridium botulinum* organisms and toxin. This was the second episode of botulism associated with a low acid garlic-in-oil product which needs constant refrigeration. In response, the Food and Drug Administration has taken steps to prevent a recurrence by requiring that microbial inhibitors or acidifying agents be added to such products. (*Am J Public Health* 1990; 80:1372–1373.)

Introduction

Each year 20 to 30 cases of foodborne botulism, usually associated with home canned foods, are reported in the United States.[1,2] When commercial products are implicated, further regulatory action is required. Although most cases have involved fish, meat, or low acid canned vegetables, recent outbreaks have implicated vegetable tubers or roots cooked or coated in oil.[2–6]

During February 1989, we investigated three cases of type A botulism and implicated a chopped garlic-in-oil product. This investigation along with an earlier garlic-in-oil outbreak of 36 cases of type B botulism[5] and laboratory studies documenting the product's potential risk for botulism,[7] led the Food and Drug Administration (FDA) to impose regulatory changes in the product's formulation.

Methods

Reports of three cases of clinically diagnosed botulism led to extensive clinical, epidemiologic, and laboratory studies. The clinical studies included neurologic examinations, electromyographic studies, tensilon tests (to rule out myasthenia gravis), and lumbar punctures prior to administration of trivalent ABE antitoxin. The epidemiologic investigation included food histories, food preparation reviews, and collection of implicated food specimens. Laboratory studies included testing of stool, serum, and implicated food specimens for botulinum toxin using the mouse bioassay, and for *Clostridium botulinum* organisms by standard culture methods.[8,9] Water activity which is a measure of the free water available for bacterial growth (*C. botulinum* requires a water activity of 0.93–1.00) was also determined for the implicated food using standard methods.[10]

Results

Case Histories

Between February 21–23, 1989, three persons were admitted to Kingston City Hospital, Kingston, New York with signs and symptoms consistent with botulism. The index case was a 45-year-old obese, White male who presented with a two-day history of bloating, diarrhea, nausea, and vomiting followed by diplopia, weakness, slurred speech, and dyspnea. He was afebrile and had normal vital signs, but was mildly tachypneic. Neurologic examination revealed bilateral ptosis with lateral and medial rectus paresis, dysarthria, diminished gag reflex, and proximal muscle weakness severe enough that he could not stand without assistance. The other two patients, ages 43 and 42, had similar but milder gastrointestinal and neurologic symptoms.

Admission screening laboratory tests were normal and all three had negative tensilon tests. Cerebrospinal fluid examinations performed on two patients were normal. Electromyography was refused by one patient, was normal on a second, and showed nonspecific findings consistent with a neuromuscular disorder on the third.

All three patients were admitted to the intensive care unit and given trivalent ABE antitoxin for progressive neurologic dysfunction. They were hospitalized for 29, 8, and 8 days, respectively. All patients recovered, but one required intubation and mechanical ventilation, and one developed serum sickness 12 days after antitoxin administration. (More complete details are available upon request to the author.)

Epidemiologic Investigation

Patient interviews implicated a February 19 dinner at the home of the index case as the only common source exposure. Symptoms began 35 to 40 hours after this meal. Several food items were eaten more commonly by cases than by four well persons, including cheese balls, meatballs, pasta, crackers, coffee, and garlic bread.

All these items, except the garlic bread and meatballs, had been served to several unaffected persons the night before. Approximately 15 pieces of garlic bread were eaten by the index case, two by each of the other cases, and one by a person who remained asymptomatic. The garlic bread was prepared by mixing two teaspoons of garlic-in-oil with warm margarine and spreading it on pieces of pita bread. The garlic

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bread was wrapped in aluminum foil and heated in an oven (300 degrees Fahrenheit) for 20 minutes prior to serving.

The implicated chopped garlic in olive oil product was processed sometime between 1985 and September 1987. It was prepared by mixing chopped garlic, ice water, and extra virgin olive oil without chemical or acid additives and was labeled with "keep refrigerated" in small print. The index patient recalled receiving the product as a gift during the summer of 1988 and storing the jar at room temperature for approximately three months. Since opening the product six months prior to illness, he had kept it refrigerated and had used only small quantities in cooked food items.

Laboratory Findings

Serum samples from each patient were negative for toxin using the mouse bioassay when the usual inoculum was administered. However, when the inoculum was increased four-fold, *Clostridium botulinum* toxin type A was demonstrated in the serum of two patients. Stool specimens from all three patients were positive for *C. botulinum* toxin type A organisms, but negative for toxin.

Type A botulism toxin was detected in left over garlic-in-oil at a concentration of 2 × 10 mouse ip LD50 units per gram of garlic product. Live *C. botulinum* toxin type A organisms were isolated at a concentration greater than 10 colony forming units per gram of garlic. The garlic-in-oil had a pH of 5.7 and a water activity of 0.932.

Discussion

This outbreak marked the second time that a commercial garlic-in-oil product had been associated with botulism food poisoning. In 1985, 36 cases of type B botulism in Vancouver, Canada[5] were linked to consumption of a chopped garlic in soybean oil product made by the same processor. In both incidents, the implicated garlic product was an aqueous mixture with a pH above 4.5 prepared without heat treatment or chemical or acid additives. Both products were marked with instructions to keep refrigerated, but had been stored at room temperature.

Type A *C. botulinum* has been commonly isolated from garlic bulbs grown in soil.[7] *Clostridium botulinum* bacteria can grow and produce botulinum toxin in unrefrigerated garlic-in-oil products lacking antimicrobial agents without affecting the taste and smell of the product.[7] Toxin production has been shown even when small numbers (one to five spores per gram) of *C. botulinum* spores are present if the product is stored at room temperature.[7] When spore-containing garlic is bottled and covered with oil, an oxygen-free environment is created which can lead to spore germination, microoganism growth, and toxin production.

This is one of several recent episodes of botulism involving vegetable tubers or roots (e.g., potatoes, onions, garlic, lotus-rhizome) cooked or stored in oil.[2-6] Such food items grow in soil where botulinum spores are common. While safeguards need to be established for commercially prepared vegetable in oil products, home owners and food preparers should also know that similar home made mixes could pose a risk for botulism if prepared and held at room temperatures. Preparing fresh products offers the greatest margin of safety.

In response to this outbreak, the distributor conducted a voluntary recall of the product. The New York and New Jersey Health Departments issued press releases warning consumers of the potential of botulism from this or similar products, of the need for continuous refrigeration and to discard any unrefrigerated product. Because of the inherent danger associated with this type of product if left unrefrigerated, the FDA and the New York State Department of Agriculture and Markets ordered companies to stop making any garlic-in-oil mixes which are only protected by refrigeration.[11] For safety, such products must now contain specific levels of microbial inhibitors or acidifying agents such as phosphoric or citric acid.

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